INVESTIGATION OF SORPTION OF METHYLENE BLUE (MB) DYE ON THERMALLY TREATED BRICK CLAY PARTICLES

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ABEKOON JAYASEKARA MUDDHIYANSELAGE ANURUDDHIKA KUMARI ABEKOON JAYASEKARA

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A.J.M.A.K.A. Jayasekara
Department of Chemistry
University of Peradeniya
Peradeniya
Sri Lanka

A major problem concerning textile wastewater is the colored effluent. The discharge of color waste not only damages the aesthetic nature of receiving streams but also causes toxic environment to aquatic life. In addition, color interferes with the transmission of sunlight into the stream, and therefore reduces photosynthetic action.

Various techniques such as precipitation, ion exchange, chemical oxidation and adsorption have been used for the removal of toxic pollutants from wastewater. Although chemical methods are more effective, use of naturally available substances are cost-effective and environmentally friendly.

In this study, methylene blue (MB) is selected as a model compound for evaluating the potential of brick clay to remove dyes from wastewaters. MB is a thiazine (cationic) dye, which is most commonly used for coloring paper and hair and dyeing cottons, wools, and so on. Although MB is not considered to be a very toxic dye, it can cause harmful effects on living organisms. After inhalation, symptoms such as difficulties in breathing, vomiting, diarrhea and nausea can occur in humans.

Factors affecting adsorption, such as pH, contact time, ionic strength, and heat treatment on the extent of adsorption of MB by brick clay a clay mineral containing more than 92% SiO_2.were focused in this study.

There is no significant effect of firing temperature on the extent of removal. The temperature of 500 °C was selected as the optimum firing temperature as the percentage

removal shows a maximum at this temperature. Further, the optimum stirring time was determined to be 10 min, and all subsequent experiments were conducted with this stirring time. Comparison of turbidity of brick clay particle suspension to which MB is added and the extent of MB removal clearly indicates that the optimum temperature for the highest removal and lowest turbidity is 500 °C. The effect of ionic strength on the adsorption of MB onto fired brick clay was studied using KNO_3 as the background electrolyte. Further, within the KNO_3 concentration range investigated about 98% MB removal was observed for 200.0 mg dm^{-3} MB solution, which was not changed even at high ionic strengths. It is therefore proposed that inner-sphere complexes between MB and surfaces of minerals present in brick clay be formed.

Interaction of MB - brick particles is highly dependent on the concentration of MB in solution showing an increased trend from concentrations up to 200 ppm MB. Both the Langmuir and Freundlich models show satisfactory agreement with the results obtained. Therefore it is suggested that the Initial monolayer coverage up to a multilayer process is continued. The value of the separation factor indicates that the brick clay-MB system is favorable as far as an adsorption phenomenon is considered. There is no significant impact of the medium pH within a range of pH from 2 to 11, providing further support for the inner-sphere complex formation.

FTIR spectra obtained before and after adsorption of MB indicate that new peaks appear after the interaction of MB. Repeated washing of the MB-adsorbed brick clay particles do not show any changes in the spectral peaks demonstrating the strong affinity of MB on brick clay particles. It shows that the Si-OH is sensitive to the coverage by MB dye.

Such finding would be extremely important in designing effluent treatment methodologies using fired brick clay, a low-cost and a readily available material.